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Service Station Facility

Facility Environmental Monitoring Report

Calendar Year 2003



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Prepared by
D. Paquette and J. Williams
Environmental and Waste Management Services Division

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Brookhaven National Laboratory Service Station Facility

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Summary of Results

Carbon tetrachloride and its breakdown products continue to be detected in groundwater surveillance wells used to monitor the Service Station facility. The carbon tetrachloride was released from a former underground storage tank that was located approximately 200 feet northwest (upgradient) of the station. As the result of active groundwater remediation, carbon tetrachloride concentrations in the Service Station wells have decreased from approximately 4,500 µg/L in 2000 to 120 µg/L in September 2003.

As in past years, volatile organic compounds associated with petroleum products (e.g., ethylbenzene, xylene, trimethylbenzenes and MTBE) and the solvent tetrachloroethylene continue to be detected in groundwater at concentrations exceeding groundwater quality standards. During 2003, several concentration spikes were observed. MTBE concentrations increased to 144 µg/L, xylene (total) increased to 237 µg/L, and trimethylbenzenes (total) increased to 82 µg/L.

The increases in volatile organic compound concentrations lead to the implementation of the Groundwater Protection Contingency Plan, which included a review of gasoline product reconciliation records and monitoring procedures. This review indicated that the station's underground storage tanks and associated distribution lines are not leaking. Furthermore, all waste oils and used solvents are being properly stored and recycled. It is believed that the tetrachloroethylene and petroleum-related compounds detected in groundwater originate from historical vehicle maintenance.

During 2003, there were eight instances when a gasoline supplier failed to provide proper documentation to show that the gasoline delivered to the Upton Service Station conformed to State and Federal formulation requirements.

Background

Building 630 is a commercial automobile service station that is privately operated under a contract with BNL. Potential environmental concerns at the service station include the historical use of underground storage tanks (USTs) to store gasoline and waste oil; hydraulic fluids used for lift stations; and the use of solvents for parts cleaning. In August 1989, the gasoline and waste oil USTs, pump islands, and associated piping were upgraded to conform to Suffolk County Article 12 requirements for secondary containment, leak detection devices, and overfill alarms. During the removal of the old USTs, no obvious signs of soil contamination were observed. The present tank inventory includes three 8,000-gallon USTs used to store unleaded gasoline, one 500-gallon UST for waste oil, and one 1,000-gallon UST for fuel oil. The facility also has three vehicle lift stations.

Groundwater quality in the service station area has been impacted by historical small-scale spills of oils, gasoline, and solvents as a result of station operations, and carbon tetrachloride releases from a UST located approximately 200 feet northwest (upgradient) of the station. The UST, which had been used as part of a Chemistry Department experiment conducted in the 1950s, was removed in April 1998. Although there are indications that the tank was releasing small quantities of carbon tetrachloride prior to the tank removal, a significant increase in carbon tetrachloride concentrations in groundwater indicated that additional amounts of this chemical were inadvertently released during the excavation and removal process. BNL started to remediate the carbon tetrachloride plume in October 1999.

Environmental Monitoring Program

In 1996, BNL established a groundwater monitoring program at the service station to evaluate potential impacts to environmental quality. The environmental monitoring program for the service station is described in the *BNL Environmental Monitoring Plan* (BNL, 2003a).

Monitoring Results

Groundwater

The service station's groundwater monitoring program is designed to confirm that the current engineered and institutional controls are effective in preventing additional contamination of the aquifer. Five wells are used to monitor for potential contaminant releases (Figure 1).

During 2003, carbon tetrachloride and its breakdown product chloroform continued to be observed in the service station monitoring wells (Tables 1 through 4). The maximum carbon tetrachloride concentration was 278 µg/L, observed in the May 2003 sample from well 085-17. The New York State Ambient Water Quality Standard (NYSAWQS) for carbon tetrachloride is 5 µg/L. Carbon tetrachloride concentrations decreased during the year, with concentrations dropping to less than 120 µg/L by September (Figure 2). These levels are considerably less than those observed in CY 2000, when carbon tetrachloride concentrations in wells near the service station approached 4,500 µg/L, and reflects the effectiveness of the groundwater restoration system (see the *BNL Groundwater Status Report for 2003* for details on the carbon tetrachloride plume and remediation system).

In addition to the carbon tetrachloride contamination from the former UST area, groundwater quality has been affected by a variety of VOCs that appear to be related to historical service station operations. During 2003, high levels (>100 µg/L) of petroleum-related compounds such as xylene and ethylbenzene were detected in wells 085-17 and 085-236, and 085-237 (see Figures 3, 4 and 5). Samples collected from well 085-17 in July 2003 contained m/p xylene at 129 µg/L, o-xylene at 108 µg/L, 1,2,4-

trimethylbenzene at 60 µg/L, 1,3,5-trimethylbenzene at 22 µg/L, and the solvent tetrachloroethylene at a concentration of 22 µg/L (Figure 3). A similar increase in VOC concentrations was observed in the March 2003 sample from well 085-236 (Figure 4).

The gasoline additive methyl tertiary butyl ether (MTBE) continues to be detected wells 085-236 and 085-237, at concentrations exceeding the NYS AWQS of 10 µg/L. MTBE levels increased from a maximum concentration of 32 µg/L in 2002, to a maximum concentration of 144 µg/L in the July 2003 sample from well 085-237 (Figure 5). MTBE levels dropped to <50 µg/L by October 2003.

Monitoring wells 085-17, 085-236, and 085-237 are downgradient of the southern end of the service station building, and it is possible that the PCE and petroleum-related chemicals detected in groundwater are due to historical discharges to the abandoned service bay floor drains (see BNL, 2003b). MTBE was used as a gasoline additive from 1977 until early 2003, and it is likely that the MTBE detected in the service station wells is related to historical vehicle maintenance operations and/or small-scale spillage of gasoline during vehicle refueling.

Evaluation of Service Station Operations

During 2003, there were no reported gasoline or motor oil losses or spills, and all waste oils and used solvents generated from current operations are being properly stored and recycled. The gasoline storage tanks have electronic leak detection systems, and there is a daily product reconciliation (i.e., an accounting of the volume of gasoline stored in underground storage tanks and volume of gasoline sold). As part of the Groundwater Protection Contingency Plan response to the detection of increased VOC concentrations (especially MTBE) in mid-2003, personnel from Staff Services reviewed the product reconciliation records and monitoring procedures. Based upon this review, there were no indications that the underground storage tanks or associated piping are leaking (Hauptman, 2003).

Documentation for gasoline deliveries from two of three suppliers delivering gasoline to the Service Station in 2003 had sufficient information to show that the gasoline received conformed with federal gasoline reformulation and detergent additive requirements and state VOC requirements. Bills of lading accompanying deliveries made by the third supplier did not contain information to show that conforming gasoline was delivered.

Future Monitoring Actions

During the CY 2004:

- The service station facility wells will be sampled semiannually for VOCs and tested for the presence of floating product.

- Staff Services Division will continue to review reconciliation records on a frequent basis.
- Staff Services Division will ask the terminal operator to supply the proper documentation to show that conforming gasoline was delivered in 2003. The terminal operator will also be asked to add requisite formulation, detergent additive and VOC requirements conformance information to bills of lading accompanying future deliveries to BNL. Finally, Staff Services has been asked to add conditions to its contract with Upton Industries, Inc. such that gasoline will only be accepted from suppliers that provide documentation to show that the gasoline conforms to applicable state and federal formulation requirements.

References

BNL, 2003a. *Brookhaven National Laboratory Environmental Monitoring Plan Triennial Update* (January 2003). BNL-52676.

BNL, 2003b. CY 2002 Facility Environmental Monitoring Report for the Service Station (July 7, 2003).

Hauptman, H, 2003. Gasoline Reconciliation Summary for Building 423 and 630 (September 23, 2003).

Table 1. February 2003 VOC Analytical Results for Service Station Facility Groundwater Monitoring Wells.

Compound	NYS AWQS (ug/L)	2/25/2003	2/25/2003	2/25/2003	2/25/2003	3/10/2003
		085-16	085-17	085-236	085-237	085-235
		Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
524.2 TVOC		68.4	114.1	309	68.1	--
Benzene, 1,2,4-trimethyl	5	0.5 U	0.5 U	56.7	0.5 U	--
Benzene, 1,3,5-trimethyl-	5	0.5 U	0.5 U	18.1	0.5 U	--
Carbon tetrachloride	5	60.4	92.6 D	139 D	61.4	77
Chloroform**	7	8	15	15.6	6.1	11.6
Ethylbenzene	5	0.5 U	0.5 U	2.1	0.5 U	2 U
m/p xylene	5	0.5 U	0.5 U	35.7	0.5 U	2 U
Methyl tert-butyl ether	10	0.5 U	0.5 U	0.5 U	0.5 U	2 U
Methylene chloride**	5	0.5 U	0.5 U	0.5 U	0.5 U	2 U
Naphthalene	10	0.5 U	0.5 U	0.5 U	0.5 U	--
n-Propylbenzene	5	0.5 U	0.5 U	8.1	0.5 U	--
o-Xylene	5	0.5 U	0.5 U	10.5	0.5 U	2 U
Tetrachloroethylene	5	0.5 U	6.5	5.8	0.6	2 U
Toluene	5	0.5 U	0.5 U	0.5 U	0.5 U	2 U

U = Compound not detected.

B = Compound also detected in blank sample.

J = Estimated analytical value.

D = Analytical value following dilution.

** Primary breakdown products of carbon tetrachloride

Table 2. May 2003 VOC Analytical Results for Service Station Facility Groundwater Monitoring Wells.

Compound	NYS AWQS (ug/L)	5/15/2003	5/15/2003	5/15/2003	5/15/2003
		085-16	085-17	085-236	085-237
		Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
524.2 TVOC		35.1	530.08	94.1	199.8
Benzene, 1,2,4-trimethyl	5	0.5 U	20	0.5 U	0.5 U
Benzene, 1,3,5-trimethyl-	5	0.5 U	0.5 U	0.5 U	0.5 U
Carbon tetrachloride	5	27	278 D	64	153 D
Chloroform**	7	5.7	22.4	10.4	16.5
Ethylbenzene	5	0.5 U	0.26 J	0.5 U	0.5 U
m/p xylene	5	0.5 U	20.5	0.5 U	0.5 U
Methyl tert-butyl ether	10	0.5 U	1.7	15.8	28.4
Methylene chloride**	5	0.5 U	0.5 U	0.5 U	0.5 U
Naphthalene	10	0.5 U	4.1	0.5 U	0.5 U
n-Propylbenzene	5	0.5 U	2	0.5 U	0.5 U
o-Xylene	5	0.5 U	79.8	0.5 U	0.5 U
Tetrachloroethylene	5	0.43 J	16.9	3.9	1.9
Toluene	5	0.5 U	0.86 U	0.5 U	0.5 U

U = Compound not detected

B = Compound also detected in blank sample.

D = Analytical value following dilution.

J = Estimated analytical value.

** Primary breakdown products of carbon tetrachloride

Table 3. July 2003 VOC Analytical Results for Service Station Facility Groundwater Monitoring Wells.

Compound	NYS AWQS (ug/L)	7/31/2003	7/31/2003	7/31/2003	7/31/2003
		085-16	085-17	085-236	085-237
		Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
524.2 TVOC		54.56	719.86	119.5	277.8
Benzene, 1,2,4-trimethyl	5	0.5 U	60.4	0.5 U	0.5 U
Benzene, 1,3,5-trimethyl-	5	0.5 U	22.1	0.5 U	0.5 U
Carbon tetrachloride	5	42.9	194 D	86.1	114 D
Chloroform**	7	9.7	27.2	14.5	17
Ethylbenzene	5	0.5 U	6.3	0.5 U	0.5 U
m/p xylene	5	0.5 U	129	0.5 U	0.5 U
Methyl tert-butyl ether	10	0.5 U	1.5	13.4	144 D
Methylene chloride**	5	0.5 U	0.5 U	0.5 U	0.5 U
Naphthalene	10	0.5 U	17.8	0.5 U	0.5 U
n-Propylbenzene	5	0.5 U	10.8	0.5 U	0.5 U
o-Xylene	5	0.5 U	108 D	0.5 U	0.5 U
Tetrachloroethylene	5	0.88	21.4	5.5	2.8
Toluene	5	0.5 U	2.1	0.5 U	0.5 U

U = Compound not detected
 B = Compound also detected in blank sample
 J = Estimated analytical value
 D = Analytical value following dilution

** Primary breakdown products of carbon tetrachloride.

Table 4. September-October 2003 VOC Analytical Results for Service Station Facility Groundwater Monitoring Wells.

Compound	NYS AWQS (ug/L)	9/9/2003	9/9/2003	9/9/2003	9/9/2003	10/31/2003
		085-235	085-17	085-236	085-237	085-16
		Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)	Conc. (ug/L)
524.2 TVOC		--	399.18	108.6	134.3	45.61
Benzene, 1,2,4-trimethyl	5	--	31	0.5 U	0.5 U	0.5 U
Benzene, 1,3,5-trimethyl-	5	--	0.5 U	0.5 U	0.5 U	0.5 U
Carbon tetrachloride	5	71.4	120 D	72 D	67 D	35 J
Chloroform**	7	15.8	22	16 J	15 J	8.7 J
Ethylbenzene	5	2 U	0.5 U	0.5 U	0.5 U	0.5 U
m/p xylene	5	2 U	48	0.5 U	0.5 U	0.5 U
Methyl tert-butyl ether	10	1 J	1.9	14 J	50 J	0.5 U
Methylene chloride**	5	2 U	0.5 U	0.5 U	0.5 U	0.5 U
Naphthalene	10	--	9.3	0.5 U	0.5 U	0.81 J
n-Propylbenzene	5	--	3.6	0.5 U	0.5 U	0.5 U
o-Xylene	5	2 U	66	0.5 U	0.5 U	0.5 U
Tetrachloroethylene	5	2 U	22	6.6 J	2.3 J	1.1 J
Toluene	5	2 U	0.98	0.5 U	0.5 U	0.5 U

U = Compound not detected

B = Compound also detected in blank sample

J = Estimated analytical value

D = Analytical value following dilution

** Primary breakdown products of carbon tetrachloride.

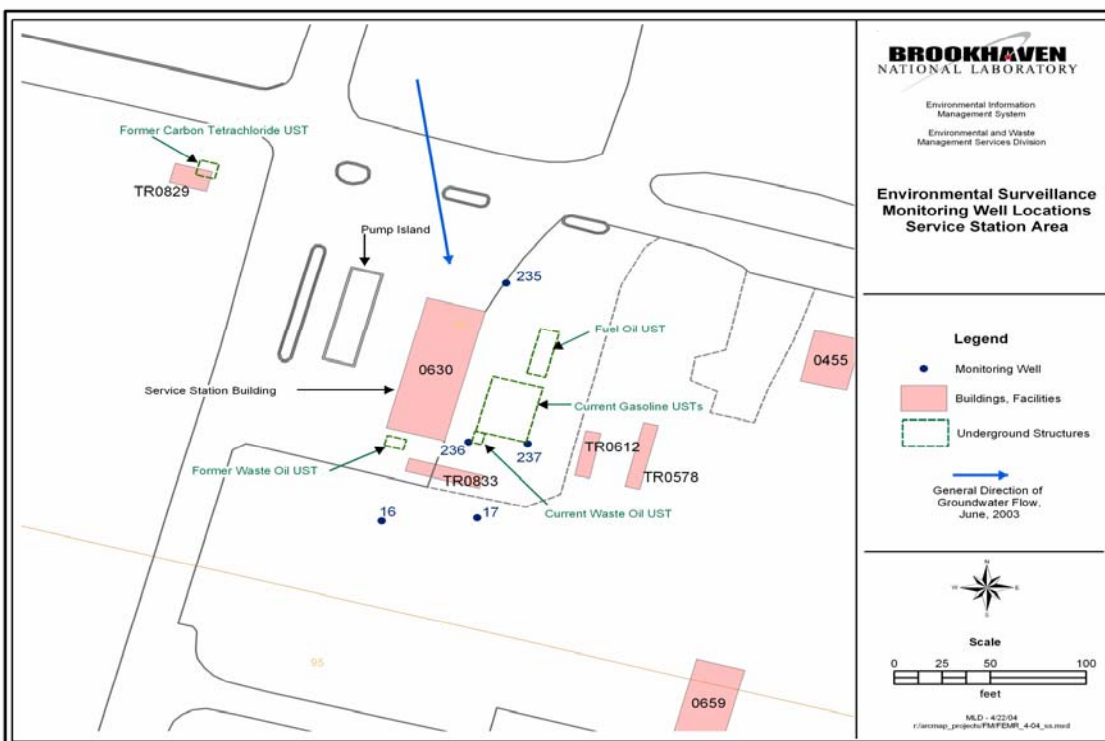


Figure 1. Locations of groundwater monitoring wells at the Service Station.

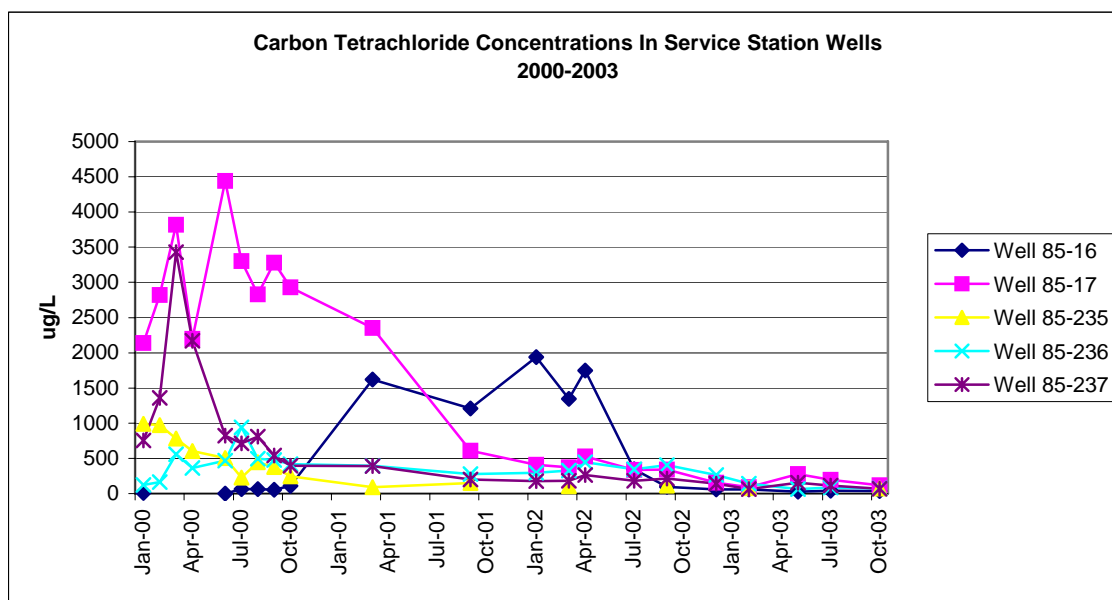


Figure 2: Trend of carbon tetrachloride concentrations in Service Station groundwater monitoring wells.

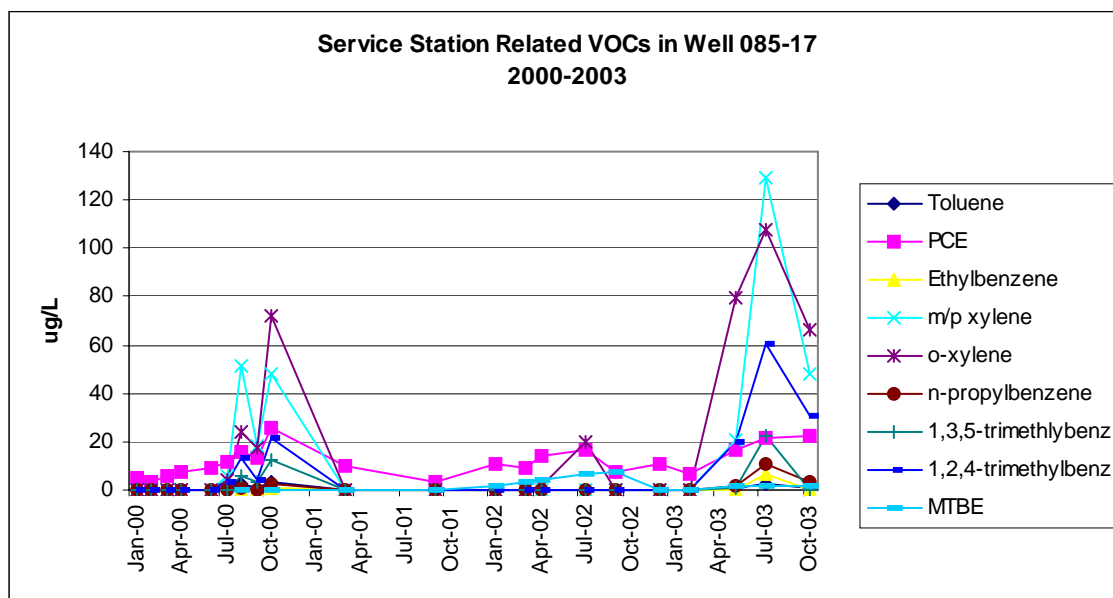


Figure 3. Trend of Service Station-Related VOCs in Downgradient Well 085-17. Note that carbon tetrachloride originating from the upgradient CCl₄ UST source area is not included.

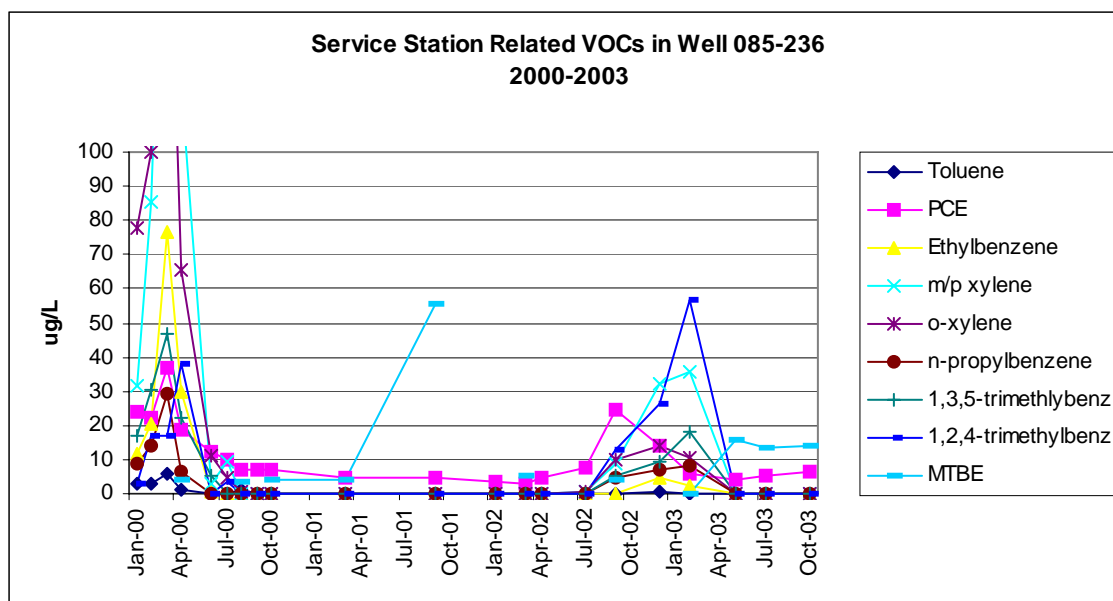


Figure 4. Trend of Service Station-Related VOCs in Downgradient Well 085-236. Note that carbon tetrachloride originating from the upgradient CCl₄ UST source area is not included.

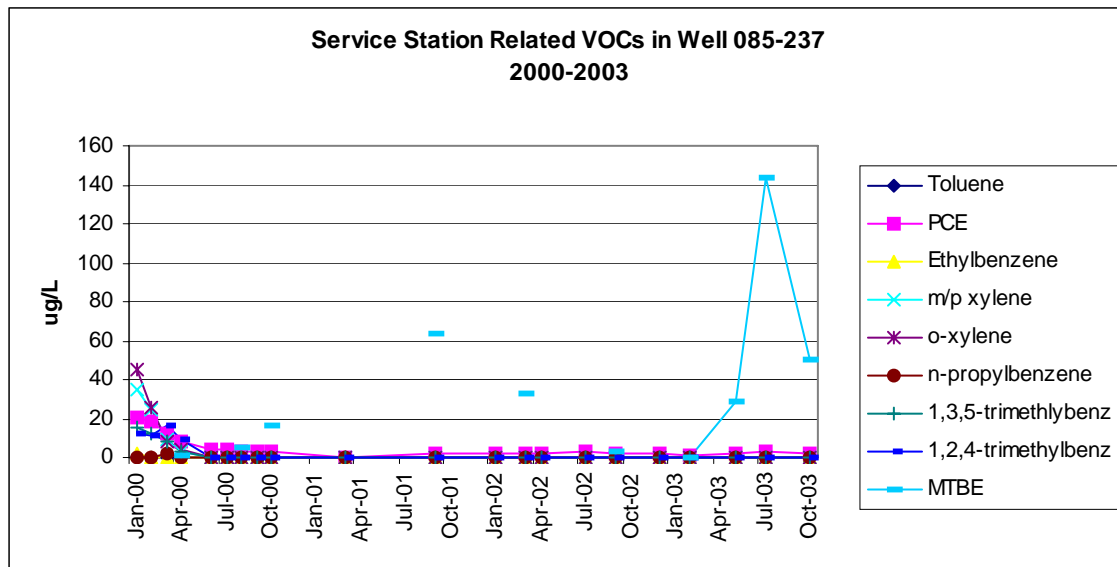


Figure 5. Trend of Service Station-Related VOCs in Downgradient Well 085-237. Note that carbon tetrachloride originating from the upgradient CCl₄ UST source area is not included.